

CLAIMS

Kindly cancel claims 11-14, and rewrite claims 19, 21-26 as follows:

1. (previously canceled) A catheter comprising:
 - a first high pressure supply lumen;
 - a second low pressure discharge lumen;
 - said low pressure discharge lumen defining a central axis;
 - said high pressure supply lumen having a proximal end and having a distal end;
 - a slit communicating with said high pressure lumen proximate said distal end,
 - said slit directing a jet of fluid in a direction away from said central axis;
 - a control body positioned proximal of said slit to turn said sheet jet through an angle with respect to said central axis;
 - a sheath surrounding said body defining a throat for providing pressure recovery for said jet.
2. (previously canceled) The device of claim 1, further including an aperture located proximal of said distal end for receiving a guide wire.
3. (previously canceled) A thrombectomy catheter comprising:
 - a discharge lumen;
 - a fluid supply lumen;
 - said supply lumen connected to a nozzle;
 - whereby said nozzle generates a jet of fluid;
 - a control body located proximate said nozzle;
 - whereby said fluid jet attaches to and follows said control body, generating a fluid flow;
 - a throat communicating with said discharge lumen for directing said fluid flow out of said discharge lumen.
4. (previously canceled) A catheter for removing occlusive material from a patent comprising:
 - a fluid supply lumen terminating in a nozzle said nozzle forming a fluid jet;
 - a control body located proximate said jet for limiting entrainment on one side of said jet;
 - whereby said jet becomes attached to said body and follows the contour of said body;

- a discharge lumen located proximate said body to receive fluid from said jet.
5. (previously canceled) A catheter having a distal end and having a proximal end, said catheter comprising:
- a high pressure lumen;
 - a low pressure lumen;
 - a deflected jet proximate said distal end for collecting occlusive material and for directing said occlusive material into said low pressure lumen.
6. (previously canceled) A device of claim 5 further including a impeller located distal of said deflected jet.
7. (previously canceled) A device of claim 5 further including a blade located distal of said deflected jet.
8. (previously canceled) The device of claim 5 further including a sonic probe located distal of said deflected jet.
9. (previously canceled) The device of claim 5 further including a radio frequency energy probe located distal of said deflected jet.
10. (previously canceled) The device of claim 5 further including an ultrasonic energy probe located distal of said deflected jet.

11. (cancel) A catheter system for removing embolic material from a vessel comprising:

a fluid supply catheter having a catheter body, said catheter body having a distal tip, said fluid supply catheter having a fluid supply lumen and having at least one distal aperture for injecting fluid into said vessel;

said fluid supply lumen receiving fluid at a first supply rate;

said distal aperture directing fluid so that a component of flow flows retrograde;

a sheath having a distal tip and having an internal lumen for exhausting fluid and debris from said vessel, said sheath having an outside diameter to fit within said vessel partially occluding blood flow but not totally occluding blood flow;

said fluid supply catheter located within said sheath and adapted for motion

with respect to said sheath;

whereby said catheter body can be moved independently of said sheath distal tip.

12. (cancel) A catheter system according to claim 11 wherein said internal diameter of said sheath is larger than the maximum diameter of said catheter.

13. (cancel) A catheter system according to claim 11 wherein said internal diameter of said sheath is substantially equal to the maximum diameter of said catheter.

14. (cancel) A catheter comprising:

a catheter body having a proximal end and having a distal end;

said catheter body defining an axis;

said distal end having an approximately circular cross section;

a fluid injection lumen in said catheter body terminating near the distal end, for connection to a device for injecting fluid at a first rate;

one or more apertures at the distal end of the catheter body, connecting the fluid supply lumen with the exterior surface of said catheter body;

said aperture defining at least one aperture direction for the emerging flow that lies between approximate ninety degrees and zero degrees, as measured from an axis along the catheter body, where zero degrees corresponds to a directly retrograde flow and ninety degrees corresponds to lateral ejection from the catheter body;

said aperture cooperating with said catheter body to direct a flow of fluid emerging from said aperture along said catheter body such that fluid flows in a retrograde direction from said distal end toward said proximal end.

15. (previously canceled) The catheter of claim 14 wherein said annular aperture is formed by a set of individual holes.

16. (previously canceled) The catheter of claim 15 wherein said set of individual holes are substantially equidistant around the periphery of said distal end of said catheter.

17. (previously canceled) The catheter of claim 16 wherein said holes are approximately round in cross section.

18. (previously canceled) The catheter of claim 16 wherein said holes are approximately rectangular in cross section.

19. amended) A catheter comprising:

a catheter body having a proximal end and having a distal end;

said catheter body defining an axis;

a fluid supply lumen in said catheter body terminating near the distal end, for connection to a device for injecting fluid at a supply rate;

one or more apertures at the distal end of the catheter body, connecting the fluid supply lumen with the exterior surface of said catheter body;

said aperture defining at least one aperture direction for the emerging flow that lies between approximate ninety degrees and zero degrees, as measured from an axis along the catheter body, where zero degrees corresponds to a directly retrograde flow

and ninety degrees corresponds to lateral ejection from the catheter body;

said aperture cooperating with a control body proximate said catheter body to
direct a flow of fluid emerging from said aperture along said control body such that
fluid flows in a retrograde direction from said distal end toward said proximal end;

a control body surface located immediate adjacent said aperture, providing a barrier located proximate said aperture, for limiting fluid entrainment from the location of said control body, near the aperture by the jet emerging from the aperture, whereby said jet is deflected by a pressure difference across said barrier.

20. (previously canceled) A catheter comprising:

a catheter body having a proximal end and having a distal end;

a high pressure lumen located in said catheter body;

a series of apertures communicating with said high pressure lumen;

said series of aperture substantially completely encircling said distal end;

a control body formed in said catheter body adjacent said series of apertures blocking fluid entrainment from the area proximal of said apertures by a jet emerging from said apertures.

21. The catheter device of claim 19 wherein a tangent drawn to said control body surface at the location of the aperture is parallel to the aperture direction.

22. The catheter device of claim 19 wherein a tangent drawn to said control body surface at the location of the aperture forms an included angle with the aperture direction that is greater than zero degrees and less than ninety degrees.

23. A extraction catheter system for removing embolic material from a vessel having a vessel diameter, said system comprising:

a sheath having a sheath lumen adapted to receive and guide a catheter, said sheath having an exterior diameter sized to fit in said vessel partially occluding but not totally occluding said vessel;

said catheter having a catheter body having a distal end and a proximal end and having an interior and an exterior surface;

a fluid supply lumen in said catheter body, for connection to a device for injecting fluid at a first rate;

a fluid port connecting said fluid supply lumen with the exterior surface of said catheter body;

said fluid port located proximate a control body whereby said fluid port and said control body cooperating to attach fluid ejected from said fluid port to said control body;

whereby said fluid ejected by said port mixes with embolic material and follows the catheter body in a retrograde direction, transporting the fluid and embolic material into said sheath lumen where it is collected at a second rate.

24. The catheter system of claim 23 wherein said catheter distal end is located within said sheath lumen.

25. The catheter system of claim 23 wherein said catheter distal end is located outside said sheath lumen.

26. A method of using a catheter system to remove material in a vessel comprising:

advancing a sheath having a sheath lumen to a location near material to be removed,
said sheath partially but not totally occluding said vessel;

advancing a catheter of the type having a fluid port to eject fluid proximate a control
body thus creating a retrograde flow, through said sheath lumen to a location near
material to be removed;

injecting fluid into said catheter causing fluid to emerge from the catheter,
entraining material located near said catheter;

removing said fluid and entrained flow from said sheath lumen.